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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the method for forming thin film which forms a thin film in the film formation surface of bases, such as a substrate, so that the shape of the opening of a mask may be transferred using a mask with two or more openings. This invention can be used when, forming the thin film which constitutes the electrode in display devices, such as an EL element of an organic system, for example.
[0002]
[Description of the Prior Art]Conventionally, using the mask with two or more openings, the film formation surface is provided with the method for forming thin film which carries out membrane formation processing so that the shape of the opening of a mask may be transferred. For example, in the thin film forming in the EL element of an organic system, Membrane formation processing is performed using the mask which made between the slit openings which carry out proximal while installing two or more slit openings of detailed width side by side the letter mask part of bridging of detailed width, The shape of the slit opening of a mask is transferred to the film formation surface of a substrate, and this installs two or more thin films of the detailed width corresponding to the slit opening of detailed width in parallel side by side, with the thin film for electrodes is formed.
[0003]
[Problem(s) to be Solved by the Invention]By the way, according to the above-mentioned method for forming thin film, it is not necessarily easy to form the thin film which transferred the shape of the opening of a mask with high degree of accuracy. While installing two or more slit openings of detailed width side by side especially, in performing membrane formation processing using the mask which made between the slit openings which carry out proximal the letter mask part of bridging of detailed width, Since both a slit opening and the letter mask part of bridging are detailed width (for example, about several 10 micrometers - about 100 micrometers of numbers), it is not necessarily easy for the rigidity of the letter mask part of bridging to form the thin film which transferred the shape of the opening of a mask with high degree of accuracy by becoming insufficient feeling on the occasion of membrane formation processing.
[0004]This invention is made in view of the above-mentioned actual condition, and let it be a common technical problem to provide a method for forming thin film advantageous to forming the thin film which transferred the shape of the opening of a mask with high degree of accuracy.

[0005]
[Means for Solving the Problem]A method for forming thin film concerning the 1st invention is in a state where a mask was made to meet a film formation surface of a base using a mask with two or more openings, and a base with a film formation surface, As shape of an opening of a mask is transferred, it is a method for forming thin film which carries out membrane formation processing of the thin film in a film formation surface, and membrane formation processing is performed, where tension is given to a mask so that curvature of a mask and bending may be suppressed.
[0006]A method for forming thin film concerning the 2nd invention is in a state where a mask was made to meet a film formation surface of a base using a mask with two or more openings, and a base with a film formation surface, As shape of an opening of a mask is transferred, are a method for forming thin film which carries out membrane formation processing of the thin film in a film formation surface, and a mask, Membrane formation processing makes an outside mask meet a field provided with an inner mask and an outside mask which is double structure at least, and makes an inner mask meet a film formation surface of a base, and faces in opposite directions to a base among inner masks, and where radiant heat to an inner mask is stopped with an outside mask, it is performed.
[0007]A method for forming thin film concerning the 3rd invention is in a state where a mask was made to meet a film formation surface of a base using a mask with two or more openings, and a base with a film formation surface, As shape of an opening of a mask is transferred, it is a method for forming thin film which carries out membrane formation processing in a film formation surface, and membrane formation processing is performed in the state where a mask was made to stick to a film formation surface of a base by a magnetic-attraction means. This invention is in a state where a mask was made to meet a film formation surface of a base using a mask with two or more openings, and a base with a film formation surface, and a method for forming thin film concerning the 4th invention has a method for forming thin film characterized by that a film formation surface comprises the following which carries out membrane formation processing of the thin film so that shape of an opening of a mask may be transferred.
An inner mask with the 1st opening group that comprised two or more 1st openings while a mask met a film formation surface of a base.
it had an outside mask with the 2nd opening that has been arranged in a field which faces in opposite directions to a base among inner masks, and was formed by a small number rather than the number of the 1st openings of an inner mask -- it being double structure at least and membrane formation processing, Operation which forms membranes in the state where the 2nd opening of an outside mask was made to meet a part of 1st opening of the 1st opening group of an inner mask.
Then, operation which forms membranes in the state where moved an outside mask and the 2nd opening of an outside mask was made to meet the 1st opening of others of the 1st opening group of an inner mask.

[0008]
[Embodiment of the Invention]According to the method concerning this invention, using a mask with two or more openings, and a base with a film formation surface, membrane formation processing of the thin film is carried out in the state where the mask was made to meet the film formation surface of a base in the film formation surface of a base so that the shape of the opening of a mask may be transferred. There is a slit opening installed long and slender along one way as an opening of the typical mask used

by this invention method. The structure which installed two or more slit openings side by side so that it might become parallel mutually is employable. In this case, it is made into the letter mask part of bridging between the slit openings which carry out proximal. The letter mask part of bridging is also made narrow, and can be made long and slender.

[0009]According to the method concerning this invention, width of a slit opening is made to detailed width. Although not limited especially as width of a slit opening, upper limit is made to 2000 micrometers, 1000 micrometers, and 100 micrometers, and a lower limit is made to 1 micrometer and 5 micrometers, for example. Width of the letter mask part of bridging is made to detailed width. Although not limited especially as width of the letter mask part of bridging, upper limit is made to 2000 micrometers, 1000 micrometers, and 100 micrometers, and a lower limit is made to 1 micrometer and 5 micrometers, for example.

[0010]As membrane formation processing concerning this invention method, if a thin film can be formed in the film formation surface of a base over a mask, publicly known membrane formation processing is employable. There is a physical film formation method as typical membrane formation processing, for example, a vacuum deposition method, sputtering process, the ion plating method, etc. can be adopted. Although the thickness of the thin film to form can be suitably chosen according to a use etc. and it is made to several 10 - 100 nm of numbers, it is not limited to this. The construction material in particular of the thin film to form is not limited. As a base, the substrate used by display devices, such as an EL element, is employable.

[0011]According to the method concerning the 1st invention, where tension is given to a mask, membrane formation processing is performed so that the curvature of a mask and bending may be suppressed. since tension is given to a mask according to the method concerning the 1st invention -- a mask -- especially, the curvature of the opening part of a mask and bending are suppressed and, thereby, the transfer accuracy of a thin film improves. According to the method concerning the 1st invention, it is common to use the tension giving means which pulls a mask and a mask holder. As a tension giving means, a mechanical tension giving means and an electric tension giving means are employable. The method which gives tension to a mask as a mechanical tension giving means using a screw pair, the method which gives tension to a mask using fluid-drive cylinders (an oil hydraulic cylinder, an air pressure cylinder, etc.), and the method which gives tension to a mask using gear mechanics are employable. It can constitute using the piezo electric crystal which generates distortion in connection with voltage impressing as an electric tension giving means, and the displacement enlarging mechanism which expands distortion of a piezo electric crystal and is transmitted to a mask holder or a mask. Or as an electric tension giving means, the driving force of an ultrasonic motor and an ultrasonic motor can be constituted using the transmission mechanism transmitted to a mask holder or a mask.

[0012]according to the method concerning the 2nd invention, the mask was provided with the inner mask and the outside mask -- it being double structure at least and membrane formation processing, An outside mask is made to meet the field which makes an inner mask meet the film formation surface of a base, and faces in opposite directions to a base among inner masks, and where the radiant heat to an inner mask is stopped with an outside mask, it carries out. According to the method concerning the 2nd invention, since the radiant heat to an inner mask is stopped with an outside mask, it can suppress that the inner mask of the side which meets the film formation surface of a base changes by thermal expansion, and the transfer accuracy of a thin film improves.

[0013]According to the method concerning the 3rd invention, membrane formation processing is

performed in the state where the film formation surface of the base was made to carry out magnetic adsorption of the mask by a magnetic-attraction means. Since according to the method concerning the 3rd invention membrane formation processing is performed where magnetic adsorption of the mask is carried out in the film formation surface of a base, the fixing degree of a mask is secured and the transfer accuracy of a thin film improves. There is a method using the electromagnet as a typical magnetic mind suction means concerning the 3rd invention or a method using a permanent magnet. Since the electromagnet can cancel magnetic attraction power except for remnant magnetization with powering off while being able to demonstrate magnetic attraction power with energization, it is advantageous to adsorption of a mask or adsorption release. According to the method concerning the 3rd invention, it is necessary to form a mask using the construction material by which magnetic attraction may be carried out. And in order to reduce the thermal expansion of a mask, it is preferred that thermal expansion nature forms with low construction material. An INVAR alloy (Fe-nickel system), a Fe-Pd alloy, etc. are one of such things. According to the method concerning the 3rd invention, the alignment of the letter portion of bridging which divides the opening of a mask is also expectable by the magnetic orientation effect based on a magnetic mind suction means.

[0014]according to the method concerning the 4th invention, the mask was provided with the inner mask and the outside mask -- it is double structure at least. An inner mask meets the film formation surface of a base, and has the 1st opening group that comprised two or more 1st openings. As for the 1st opening, being formed with the equivalent pitch interval is preferred. An outside mask is arranged in the field which faces in opposite directions to a base among inner masks, and has the 2nd opening formed by the small number rather than the number of the 1st openings of an inner mask. If the pitch interval of the 1st opening is set to Px and the pitch interval of the 2nd opening is set to Py, it can be considered as Py= (Px-n). n is two or more numerical values, and is 2, 3, 4, 5, and 6 --.

[0015]According to the method concerning the 4th invention, membrane formation processing is provided with the following.

Operation which forms membranes in the state where the 2nd opening of the outside mask was made to meet a part of 1st opening of the 1st opening group of an inner mask.

Then, operation which forms membranes in the state where moved the outside mask and the 2nd opening of the outside mask was made to meet the 1st opening of the others of the 1st opening group of an inner mask.

Therefore, it is preferred to establish the inner mask fixing means which fixes an inner mask to the film formation surface of a substrate. As an inner mask fixing means, the method which fixes an inner mask mechanically is employable, or when an inner mask is the material in which magnetic attraction is possible, the magnetic-attraction method which makes an inner mask stick to the film formation surface of a substrate using magnetic attraction can be adopted.

[0016]According to the method concerning the 4th invention, it is preferred to establish the outside mask transportation device to which an outside mask is moved. As an outside mask transportation device, the method to which it is made to move by a motor, the method to which it is made to move by a fluid pressure cylinder, and the method to which it is made to move with an actuator are employable.

[0017]

[Example](Example 1) Example 1 concerning this invention is hereafter described with reference to drawings. Drawing 1 shows a film deposition system typically. The film deposition system 1 used by this example has the vacuum housing 10 with the vacuum chamber 10a, the vacuum devices 11, such as

a vacuum pump which makes the vacuum chamber 10a a high vacuum, the source 12 of membrane formation held at the vacuum chamber 10a, and the particle means forming 13 which turns particles to the substrate as a base and makes them fly from the source 12 of membrane formation. The source 12 of membrane formation comprises the target 14 of metal (aluminum) formed with membrane formation material, and the holding container 15 holding this.

[0018]The particle means forming 13 comprises a heater which heats the target 14, or an electron beam generator which applies an electron beam to the target 14. The target 14 has length LA close to the length of the mask 3. In order to secure membrane formation accuracy, it is for enabling it to fly the particles from the target 14 to the film formation surface 6a of the substrate 6 as vertically as possible. The film deposition system 1 is equipped with the tension giving means 2 which gives tension to the mask 3.

[0019]The ** type top view of the mask 3 is shown in drawing 2. Two or more slit openings 4 with the detailed width which the mask 3 made thin plate state (thickness: about 100-500 m), and was installed side by side in parallel mutually, It has two or more letter mask parts 5 of bridging installed side by side so that it might be provided between the slit openings 4 which carry out proximal and might become parallel mutually, the holding frame part 33 provided in the surroundings of the slit opening 4, and the locked member 34 which makes the shape of a breakthrough penetrated to the thickness direction of the mask 3. The slit opening 4 and the letter mask part 5 of bridging are installed in accordance with arrow X1 direction.

[0020]Although the width L1 of the slit opening 4 is several 10 - 100 micrometers of numbers and the width L2 of the letter mask part 5 of bridging is several 10 - 100 micrometers of numbers, it is not limited to these. On these specifications, a "number" means 2-6. Thus, rigidity is not necessarily enough and it is tended to give the letter mask part 5 of bridging also in prudence, since the width of the letter mask part 5 of bridging is small.

[0021]The mask 3 is formed by an etching process. The mask 3 is formed in metal and a concrete target with an INVAR alloy or stainless steel. As shown in drawing 3, the locked member 34 of the shape of a breakthrough of the mask 3 is fitting in and engaging with the suspending portion 18 of the protuberance form of the mask holder 17. The mask holder 17 is put on the attaching part 10r in the vacuum chamber 10a, and is supported.

[0022]In this example, the substrate 6 formed with glass with the film formation surface 6a is used. And the substrate 6 is arranged above the source 12 of membrane formation, while placing the film formation surface 6a of this upside down, and the film formation surface 6a of the substrate 6 is made to meet the source 12 of membrane formation. Similarly, the mask 3 is made to intervene between the substrate 6 and the source 12 of membrane formation, and it changes into the state where the film formation surface 6a of the substrate 6 was covered with the mask 3.

[0023]While making the vacuum chamber 10a into a high vacuum (10^{-3} - 10^{-6}Pa) with the vacuum devices 11, evaporation particles are made to fly from the target 14 by the particle means forming 13, and it is made to deposit on the film formation surface 6a of the substrate 6 in this state. This performs membrane formation processing throughout a period of mask 3. As a result, two or more thin films (target thickness: a number - 100 nm of numbers) are transferred by the film formation surface 6a of the substrate 6. Each thin film is installed side by side so that it may become parallel mutually.

Band shape with the detailed width corresponding to the contour shape of the slit opening 4 of the mask 3 is made.

[0024]In this example, giving tensile force pulls membrane formation processing in the arrow X1 direction on the mask 3, and where the tension which met in the arrow X1 direction is given to the mask 3, it is performed. Moderate tension is given so that it may not pull too much. Since the curvature of the mask 3 and bending are suppressed by this, even if it is at the time narrow [the slit opening 4 and the letter mask part 5 of bridging of the mask 3], and thin, the slit opening 4 and the letter mask part 5 of bridging align with high degree of accuracy, and the transfer accuracy of a thin film improves. The direction of giving tensile force is arrow X1 direction, as described above, and it is a direction in which the slit opening 4 and the letter mask part 5 of bridging are installed.

[0025]The giving tensile force by the tension giving means 2 is canceled, and the mask 3 is made to secede from the substrate 6 after membrane formation processing. The tension giving means 2 is typically shown in drawing 3. The tension giving means 2 uses a screw pair, as shown in drawing 3. In a screw pair, the degree of rotation fate is convertible for direct-acting movement.

[0026]Namely, the screw-thread axis 22 in which the tension giving means 2 has the external threaded section 21 held at the mask holder 17 holding the mask 3, It has the operation solid of revolution 25 with the female screw part 24 screwed in the screw-thread axis 22, and the restricting part 26 which the operation solid of revolution 25 ****s, is got blocked in the axial length direction of the axis 22, and is kept from moving in the arrow X1 direction. If the operation solid of revolution 25 is suitably rotated to the hoop direction, the screw-thread axis 22 will move along the axial length direction, i.e., arrow X1 direction, by screwing of the female screw part 24 and the external threaded section 21, making the operation solid of revolution 25 into the regular position in an axial length direction. It moves in accordance with the direction, the mask holder 17 being guided by this at the attaching part 10r, with tension is given to the mask 3.

[0027]According to this example, it is advantageous to fine adjustment of the tension which becomes advantageous to fine adjustment of the movement magnitude to which the path D of the operation solid of revolution 25 ****s, and the mask holder 17 and the mask 3 are moved in accordance with arrow X1 direction since it is larger than the path of the axis 22, and is given to the mask 3. Drawing 4 shows another gestalt. In this case, the tension giving means 2A is provided with the actuator 27 with the function which pulls the mask holder 17, and the drive circuit 28 which drives the actuator 27. By energizing to the drive circuit 28, the actuator 27 is made to drive, the action part 17k of the mask holder 17 is pulled in accordance with arrow X1 direction, and tension is given to the mask 3. The actuator 27 can be constituted using an ultrasonic motor.

[0028](Example 2) Example 2 is described with reference to drawing 5. Example 2 is the same composition as fundamentally as Example 1. Hereafter, a different portion is explained as a center. In this example, as shown in drawing 5, mask 3' is the double structure which comprised the inner mask 3A and the outside mask 3B. The inner mask 3A makes thin plate state (thickness: a ten number - 100 micrometers of numbers), and the outside mask 3B is also making thin plate state (thickness: a ten number - 100 micrometers of numbers). The inner mask 3A has the slit opening 4A with the detailed width installed side by side so that it might become parallel mutually, and the letter mask part 5A of bridging provided between the slit openings 4A. The width L3 of the slit opening 4A is several 10 - 100 micrometers of numbers. The width L4 of the letter mask part 5A of bridging is several 10 - 100 micrometers of numbers.

[0029]The outside mask 3B makes the same shape substantially with the inner mask 3A. That is, the

outside mask 3B is making thin plate state, and has the slit opening 4B with the detailed width installed side by side so that it might become parallel mutually, and the letter mask part 5B of bridging provided between the slit openings 4B. As shown in drawing 5, the slit opening 4B of the outside mask 3B meets the slit opening 4A of the inner mask 3A. The letter mask part 5B of bridging of the outside mask 3B meets the letter mask part 5A of bridging of the inner mask 3A.

[0030]The inner mask 3A and the outside mask 3B are formed by an etching process, respectively. The inner mask 3A and the outside mask 3B are formed with an INVAR alloy with a small coefficient of thermal expansion, or stainless steel (austenite, JIS-SUS304). At drawing 5, the number of the slit openings 4A and 4B and the number of the letter mask parts 5A and 5B of bridging are simplified and illustrated, and there are more actual numbers.

[0031]At this example, the inner mask 3A and the outside mask 3B are held to the mask holder 17 in the state where the outside mask 3B was made to meet field $3A_0$ which makes the inner mask 3A meet the film formation surface 6a of the substrate 6, and faces in opposite directions to the substrate 6 among the inner masks 3A. Membrane formation processing is performed in this state. While making the vacuum chamber 10a into a high vacuum (10^{-3} - 10^{-6}Pa) with the vacuum devices 11, evaporation particles are made to fly from the target 14 by the particle means forming 13, and it is made to deposit on the film formation surface 6a of the substrate 6 in membrane formation processing. This performs membrane formation processing over mask 3'. As a result, two or more thin films (target thickness: a number - 100 nm of numbers) are transferred by the film formation surface 6a of the substrate 6.

[0032]If the inner mask 3A for carrying out direct transfer of the thin film in the case of membrane formation processing is covered with the outside mask 3B as described above, it will be suppressed with the outside mask 3B that direct transmission of the radiant heat from the target 14 etc. is carried out to the inner mask 3A. Therefore, modification by the thermal expansion of the inner mask 3A can be suppressed. Therefore, the slit opening 4A of the inner mask 3A and the orientation of the letter mask part 5A of bridging become is easy to be maintained good in the case of membrane formation processing, and the transfer accuracy of a thin film improves.

[0033]Drawing 6 shows another gestalt. In this case, the spacer 27 is made to intervene between the inner mask 3A and the outside mask 3B. Therefore, the crevice 38 (space width: a ten number - 100 micrometers of numbers) between the inner mask 3A and the outside mask 3B is formed certainly. This crevice 38 can function as heat transfer interception space, and it can control that the heat of the outside mask 3B which received radiant heat is transmitted to the inner mask 3A. Therefore, it is much more advantageous to suppressing modification by the thermal expansion of the inner mask 3A, and can contribute to highly precise-ization of a thin film further.

[0034]In this example, width L6 of the letter mask part 5B of bridging of the outside [width / L4 / of the letter mask part 5A of bridging of the inner mask 3A] mask 3B is made small. Since it is the inner mask 3A, the transfer shape of a thin film is determined in order to secure transfer accuracy with the inner mask 3A.

(Example 3) Example 3 is described with reference to drawing 7 and drawing 8. Example 3 is the same composition as fundamentally as Example 1. Hereafter, a different portion is explained as a center.

[0035]The mask 3 has a small coefficient of thermal expansion, and is formed with the INVAR alloy (Fe-nickel system) which is also a magnetic material. In this example, the electromagnet device 7 which functions as a magnetic mind suction means is formed in the side which faces in opposite directions to

the film formation surface 6a of the substrate 6. The electromagnet device 7 is driven by the drive circuit 70. That is, if the electromagnet device 7 energizes by the drive circuit 70, the electromagnet device 7 will do a magnetization operation so, and the electromagnet device 70 will demonstrate magnetic attraction power. If the electromagnet device 7 is powered up by the drive circuit 70, the electromagnet device 7 will demagnetize and the magnetic attraction power of the electromagnet device 7 will disappear fundamentally except for remnant magnetization.

[0036]In this example, make the electromagnet device 7 demonstrate magnetic attraction power, the film formation surface 6a of the substrate 6 is made to carry out magnetic adsorption of the mask 3 in membrane formation processing, and, thereby, the mask 3 is stuck to the film formation surface 6a of the substrate 6. In this case, if it energizes to the electromagnet device 7 and is made to make magnetic attraction power act after powering up the electromagnet device 7 and applying and positioning the mask 3 to the film formation surface 6a of the substrate 6 at the beginning, Even if it is when the letter mask part 5 of bridging of the mask 3 is narrow and thin, it is advantageous to suppressing disorder of the arrangement of the letter mask part 5 of bridging.

[0037]Since membrane formation processing is performed in this example where magnetic adsorption of the mask 3 is carried out by the electromagnet device 7 in the film formation surface 6a of the substrate 6, The fixing degree of the mask 3 in the case of membrane formation processing becomes high, especially, the degree of fixed alignment of the narrow letter mask part 5 of bridging of the mask 3 can be improved, and the transfer accuracy of a thin film improves. After membrane formation, the electromagnet device 7 is powered up and the magnetic attraction power of this is vanished. Then, the mask 3 becomes free as shown in drawing 8. Therefore, the mask 3 can secede now from the film formation surface 6a of the substrate 6.

[0038]Like the gestalt shown in drawing 9, the method which has a magnetic pole in the end part 7a and the other end 7c in a thickness direction of the mask 3 among the electromagnet devices 7 is employable. Or adopting the method which provides a magnetic pole also turns on the end part [which met the length of the slit opening 4 of the mask 3 among the electromagnet devices 7 / of a direction] 7d, and other end 7e side like the gestalt shown in drawing 10 if needed.

[0039]Or adopting the method which provides a magnetic pole also turns on the end part [of the direction which crosses to the length direction of the slit opening 4 of the mask 3 among the electromagnet devices 7] 7h, and other end 7i side like the gestalt shown in drawing 11 if needed.

(Example 4) Example 4 is described with reference to drawing 12. Example 4 has each feature of each above-mentioned example simultaneously. That is, in this example, mask 3' is the double structure which comprised the inner mask 3A and the outside mask 3B. The inner mask 3A is making thin plate state, and is provided with the slit opening 4A with detailed width, and the letter mask part 5A of bridging provided between the slit openings 4A.

[0040]The outside mask 3B is making the same shape substantially with the inner mask 3A like the above mentioned example. That is, the outside mask 3B is making thin plate state, and is provided with the slit opening 4B with detailed width, and the letter mask part 5B of bridging with detailed width. The spacer 37 intervenes between the inner mask 3A and the outside mask 3B, and the crevice 38 is formed.

[0041]The inner mask 3A and the outside mask 3B are stopped by the suspending portion 18 of the mask holder 17. The mask holder 17 is put on the attaching part 10r. The mask holder 17 is pulled by the tension giving means 2 in the arrow X1 direction, and can give moderate tension to the inner mask 3A and the outside mask 3B. In this example, the film formation surface 6a and the side facing in opposite

directions are equipped with the electromagnet device 7 among the substrates 6.
The substrate 6 is adsorbed by the electromagnet device 7 in the inner mask 3A.

[0042]In this example, after the tension giving means 2 gives tension to the inner mask 3A and the outside mask 3B, these are positioned. It energizes to the electromagnet device 7 after that, and this is magnetized. As a result, the film formation surface 6a of the substrate 6 is adsorbed in the inner mask 3A. Therefore, even if it is when the width of the letter mask part 5A of bridging of the inner mask 3A is as small as several micrometers - 10 micrometers of numbers, disorder of the arrangement of the letter mask part 5A of bridging or the letter mask part 5B of bridging can be suppressed effectively. Therefore, it is advantageous to securing the transfer accuracy of a thin film.
[0043](Example 5) Example 5 is described with reference to drawing 13 - drawing 15. Mask 3" concerning this example is the double structure provided with the inner mask 8 and the outside mask 9. The inner mask 8 is formed with the ferromagnetic material (for example, a Fe-nickel system alloy, an INVAR alloy) in which a coefficient of thermal expansion is small and its magnetic attraction is possible.
[0044]The inner mask 8 meets the film formation surface 6a of the substrate 6.
It has the 1st slit opening group 87 which comprised the 1st long and slender slit opening 80 (80a, 80b, 80c) installed side by side. [two or more]
The 1st slit opening 80 is formed with the equivalent pitch interval. The outside mask 9 is arranged at the field side which faces in opposite directions to the substrate 6 among the inner masks 8.
It has the 2nd slit opening group 97 formed by the number smaller than the number of the 1st slit openings 80 of the inner mask 8, and the 2nd long and slender slit opening 90 formed with the equivalent pitch interval.

[0045]The outside mask 9 is formed by a paramagnetic material or non-magnetic materials with low magnetic-attraction nature (for example, austenitic stainless steel, an aluminum containing alloy, etc.). If the pitch interval of the 1st slit opening 80 (80a, 80b, 80c) is set to Px and the pitch interval of the 2nd slit opening 90 is set to Py as shown in drawing 14, it will be considered as Py= (Px-n). n is set to 3.
[0046]The crevice 38 is formed between the outside mask 9 and the inner mask 8. The crevice 38 can function as heat transfer interception space, and can suppress the heat transfer to the inner mask 8 further. The upper surface side of the substrate 6 is equipped with the electromagnet device 7 for carrying out magnetic attraction of the inner mask 8. In this example, in advance of membrane formation processing, the inner mask 8 is made to stick to the film formation surface 6a of the substrate 6 with the electromagnet device 7, and it fixes. As shown in drawing 14, the outside mask 9 is held to the field side which faces in opposite directions to the substrate 6 among the inner masks 8. The 2nd slit opening 90 of the outside mask 9 is made to meet the 1st slit opening 80a of the 1st slit opening groups 87 of the inner mask 8, as this shows drawing 14.
[0047]Membrane formation processing is performed in this state. Then, the thin-film-forming substance in a vacuum chamber passes the 2nd slit opening 90 of the outside mask 9, and the 1st slit opening 80a of the inner mask 8, and accumulates on the film formation surface 6a of the substrate 6, and the thin film 100a is formed. The thin film 100a is the shape which transferred the 1st slit opening 80a of the inner mask 8. Other 1st slit opening 80b and 80c is covered with the outside mask 9 so that he can understand from drawing 14.

Membranes are not formed in this stage.

[0048]Next, the outside mask 9 is moved in accordance with the direction of arrow K5 shown in drawing 14, fixing the inner mask 8 to the substrate 6. In this case, the outside mask transportation device 97 which comprised a motor mechanism is used. Migration length is made into the distance equivalent to the pitch interval Px of the 1st slit opening 80 of the inner mask 8. As a result, the 2nd slit opening 90 of the outside mask 9 is made to meet the 1st slit opening 80b of the inner masks 8. Other 1st slit opening 80a and 80c is covered with the outside mask 9, and is accumulated, and membranes are not formed in this stage. If membrane formation processing is performed in this state, a thin-film-forming substance will pass the 2nd slit opening 90 of the outside mask 9, and the 1st slit opening 80b of the inner mask 8, and will accumulate on the film formation surface 6a of the substrate 6, and the thin film 100b will be formed. The thin film 100b is the shape which transferred the 1st slit opening 80b of the inner mask 8.
[0049]Next, the outside mask 9 is moved in accordance with the direction of arrow K5 shown in drawing 14, fixing the inner mask 8 to the substrate 6. Migration length is made into said distance which is equivalent to the pitch interval Px of the 1st slit opening 80 of the inner mask 8 similarly. As a result, the 2nd slit opening 90 of the outside mask 9 is made to meet the 1st remaining slit openings 80c of the inner mask 8. Since the 1st slit opening 80a and 80b besides this time is covered with the outside mask 9, it is not formed in this stage. If membrane formation processing is performed in this state, a thin-film-forming substance will pass the 2nd slit opening 90 of the outside mask 9, and the 1st slit opening 80c of the inner mask 8, and will accumulate on the film formation surface 6a of the substrate 6, and the thin film 100c will be formed. The thin film 100c is the shape which transferred the 1st slit opening 80c of the inner mask 8. In this example, the thin films 100a, 100b, and 100c are formed in the film formation surface 6a of the substrate 6 as mentioned above.
[0050]In this example, since the outside mask 9 has covered the inner mask 8 for carrying out direct transfer of the thin films 100a, 100b, and 100c, it can control that direct transmission of the radiant heat from a target is carried out to the inner mask 8. Therefore, modification by the thermal expansion of the inner mask 8 can be controlled. Therefore, it is advantageous to improvement in the transfer accuracy of the thin films 100a, 100b, and 100c.
[0051]In this example, although the outside mask 9 is moved in membrane formation processing, since the inner mask 8 is fixed to the film formation surface 6a of the substrate 6, it can suppress damaging the thin films 100a, 100b, and 100c currently formed in the film formation surface 6a of the substrate 6. Also in this meaning, it is advantageous to improvement in the transfer accuracy of the thin films 100a, 100b, and 100c.
[0052]The number of the 1st slit openings 80 (80a, 80b, 80c) of the inner mask 8 is larger than the number of the 2nd slit openings 90 of the outside mask 9, and it is it. [of this] [3 times] Therefore, generally the outside mask 9 is that the rigidity of the inner mask 8 of a thing advantageous to securing rigidity tends to fall rather than the rigidity of the outside mask 9. Since the outside mask 9 advantageous to securing rigidity can support from the bottom the inner mask 8 in which the rigidity of what carries out direct transfer of the thin films 100a, 100b, and 100c tends to fall in this point this example, Also in this meaning, it is advantageous to improvement in the transfer accuracy of the thin films 100a, 100b, and 100c.
[0053]In this example, the film formed with the same construction material may be sufficient as the thin

films 100a, 100b, and 100c formed in the above-mentioned substrate 6. Or each of the thin films 100a, 100b, and 100c can also be used as the film for the three primary colors. For example, the film for red (R) and the thin film 100b may be used as the film for blue (B), and the thin film 100c may be used as the film for green (G) for the thin film 100a.

[0054]If slit width of the 1st slit opening 80 of the inner mask 8 is set to L7 and slit width of the 2nd slit opening 90 of the outside mask 9 is set to L8 as this example is shown in drawing 15, L8 is set up more greatly than L7. Therefore, the transfer accuracy of the thin film by the 1st slit opening 80 of the inner mask 8 is secured.

(in addition to this) It is good also as composition which has simultaneously the tension giving means 2 which is the feature of Example 1, and the mask dual structure which is the features of Example 2.

[0055]Or it is good also as composition which has simultaneously the tension giving means 2 which is the feature of Example 1, and the electromagnet device 7 which is the features of Example 3. Or it is good also as composition which has simultaneously the mask dual structure which is the feature of Example 2, and the electromagnet device 7 which is the features of Example 3.

(Example of application) Drawing 16 and drawing 17 show the example of application. This example is a case where it applies to formation of the thin film in EL (Elecro Luminescence) element of a spontaneous luminescence type organic system. As shown in drawing 16, the illuminant layer 61 which has the transparent electrode 60 (an anode, Indium Tin Oxide) which is microelectrode, and a luminescence function on the glass substrates 6 with transparency, and the electrode thin film 52 (negative electrode) which is microelectrode are laminated in order.

[0056]The electrode thin film 52 is formed in the electrical conducting material and the concrete target with aluminum (aluminum). The illuminant layer 61 laminates the electron hole transporting bed 65, the organic luminous layer 66, and the electron transport layer 67 in order, and comprises a side near the transparent electrode 60. As the electron hole transporting bed 65, tertiary amine derivatives, such as a triphenyl diamine derivative, etc. can be illustrated. The substance known as fluorescent dye as the organic luminous layer 66 is employable. Polysilane etc. can be illustrated as the electron transport layer 67.

[0057]As shown in drawing 17, the transparent electrode 60 is installed side by side in accordance with arrow Y1 direction. The electrode thin film 52 is installed side by side in accordance with the direction which crosses to the transparent electrode 60, i.e., arrow X1 direction. Thereby, matrix arrangement is formed. In this example of application, as described above, the electrode thin film 52 (target thickness: a ten number - 100 nm of numbers) is formed using the mask 3 by carrying out membrane formation processing throughout a period of mask 3.

[0058]As described above depending on the case, it may decide to form the transparent electrode 60 (target thickness: a ten number - 100 nm of numbers) using the mask 3 by carrying out membrane formation processing throughout a period of mask 3.

[0059]

[Effect of the Invention]In order according to the method concerning the 1st invention to perform membrane formation processing where tension is given to a mask so that the curvature of a mask and bending may be suppressed, transfer accuracy with a mask improves and it becomes advantageous to forming a thin film with high degree of accuracy in the case of membrane formation processing. according to the method concerning the 2nd invention, the mask was provided with the inner mask and the outside mask -- it is double structure at least.

In order to perform membrane formation processing in the state where the outside mask was made to meet the field which makes an inner mask meet the film formation surface of a base, and faces in opposite directions to a base among inner masks, the radiant heat to an inner mask is stopped with an outside mask.

Therefore, it becomes advantageous to suppressing heat modification of an inner mask, and transfer accuracy with a mask improves and it becomes advantageous to forming a thin film with high degree of accuracy in the case of membrane formation processing.

[0060]In order to perform membrane formation processing in the state where the mask was made to stick to the film formation surface of a base by a magnetic-attraction means according to the method concerning the 3rd invention, the curvature of a mask and modification are suppressed, transfer accuracy with a mask improves, and it becomes advantageous to forming a thin film with high degree of accuracy in the case of membrane formation processing. Since the outside mask has covered the inner mask for carrying out direct transfer of the thin film according to the method concerning the 4th invention, it can control that direct transmission of the radiant heat in the case of membrane formation processing is carried out to an inner mask, and heat modification of an inner mask can be controlled, therefore it is advantageous to improvement in the transfer accuracy of a thin film. Although an outside mask is moved in membrane formation processing, since the inner mask has met the film formation surface of a substrate, it can suppress damaging the thin film currently formed in the film formation surface of a substrate, and is much more advantageous to improvement in the transfer accuracy of a thin film. In addition, the number of the 1st openings of an inner mask is larger than the number of the 2nd openings of an outside mask. Therefore, generally the rigidity of an inner mask of what has an outside mask advantageous to securing rigidity is falling rather than the rigidity of an outside mask. Since an outside mask advantageous to securing rigidity can support from the bottom the inner mask in which the rigidity of what carries out direct transfer of the thin film tends to fall according to the method concerning this 4th invention of a point, also in this meaning, it is advantageous to improvement in the transfer accuracy of a thin film.

[Translation done.]